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SINKING ASSETS:
Submarine Strategy and Force Planning for the 21st Century

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A paper submitted to the Dean of Academics of the Naval War College for the Naval Submarine League Prize essay competition. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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Abstract

The tactical submarine force has undergone one of the largest percentage force-size reductions of any major segment of the nation's armed services during the last decade. This paper examines the causes of these reductions and whether they are the natural and appropriate result of the end of the Cold War or the product of flawed force planning. The history of the first century of submarine force planning is reviewed as the foundation of the current force and the source of many of the assumptions that drive planning. Following the model of Bartlett, Holman and Some, eight different force-planning approaches – including top-down, bottom-up, scenario, threat, mission, technology, fiscal and hedging – are examined for their implications on future submarine force levels. The key issues facing submarine force planners of the next century are identified and recommendations are made for the future direction of submarine strategy and force planning.

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Introduction

"Jam Dive, Jam Dive!" To any submariner these words would indicate that one of the most feared casualties to a submarine at sea has occurred – the stern planes have failed in the down position at high speed, forcing the ship into a steep and potentially final dive below test depth. Fortunately, he and his shipmates have trained for this eventuality, and the prompt execution of frequently practiced emergency procedures by the ship control party will enable the submarine to safely pull out of the dive.

The situation for force levels of the U.S. Navy's tactical submarines (fast attack submarines, or SSN's, as opposed to strategic ballistic missile submarines or SSBN's) over the past decade could also be likened to a "Jam Dive", as attack submarine rolls declined precipitously from their Cold War levels of nearly 100 hulls to the current level of 55. Unfortunately, there is no straightforward emergency procedure we can execute to pull out of this dive and the final force levels of SSN's may well be far lower. Part of the problem is that there is so little consensus on what the minimum requirement for SSN's should be, and thus no clearly defined "test depth" above which we can focus our efforts to remain. For example, the Quadrennial Defense Review (QDR) of 1997 mandated a level of fifty SSN's in its force recommendations,¹ but the CINC's have consistently recommended a level of seventy or more SSN's to support operational requirements² and other respected defense analysts have called for retaining as few as twenty SSN's to meet the reduced threat to national security envisioned in the next century.³ The large variation in these numbers (plus

¹ Cohen, William S., *Report of the Quadrennial Defense Review*, Washington, 1997, 29.

² U.S Congress, Senate Armed Services Committee: Subcommittee on Seapower, "Hearing on Submarine Warfare", 13 April 1999, Congressional Information Service, Bethesda Md, 4.

³ Force A of Les Aspin's House Armed Services Committee study as presented in Posen and Ross's "Competing Visions for U.S. Strategy", in *Strategy and Force Planning*, 104.

or minus nearly one hundred percent!) contrasts markedly with that for other major force components in the various options of the QDR, which vary by only about ten or twenty percent whether they be Army active divisions (ranging from 8-10), Air Force active fighter wings (11-13), or Navy carrier battle groups (10-12).⁴

How did a key element of our national arsenal, responsible in large measure for our victories at sea in the Pacific during World War II and globally during the Cold War, fall into such a depressed state as we enter the next century? In an era where "stealth" is often touted as the key to success of future weapons systems, has the original stealth platform outlived its usefulness, or has it priced itself out of the market when compared with newer technologies? Does the wide variation in projected submarine requirements reflect a natural uncertainty about the future, or does it indicate a more fundamental misunderstanding of the potential roles and missions of the submarine in future conflicts? The answers to these questions can be better understood by first reviewing the path of submarine force planning over the past century, then conducting an in-depth assessment of submarine force level requirements suggested by several accepted force-planning methods, and finally by synthesizing a new strategy and force-planning approach that can better answer the "what kind and how many" questions for the submarine force of the 21st century.

Submarine Force Planning: The First Century

From their initial introduction into the world's navies at the beginning of the twentieth century, submarines have often proved troublesome for force planners, provoking acrid debates between their few ardent proponents and the much larger and generally disparaging naval establishment. As inventor John Holland stated in 1895, "the submarine is

⁴ Cohen, *QDR*, 21-22.

not like other naval vessels, compelled to select for its antagonist a vessel of about its own or inferior power: the larger and more powerful its mark, the better its opportunity."⁵ The submarine was then, as now, an *asymmetric* weapon, not easily amenable to the force-on-force fleet comparisons of gunnery and armor that were the rage of the newly scientific naval planners. The submarine, besides being regarded as vaguely unsporting, was generally relegated to a support role of scouting for the battle fleet or coastal defense.⁶ Commerce raiding was considered but discarded as a submarine mission because of the difficulty foreseen in complying with "prize rules." Even after the shocking revelations of submarine capabilities to inflict damage to major combatants during the early German U-boat campaign of World War I, the prevailing view was still that of Admiral Sir John Jellicoe, whose statement that "it is suicidal to forego our advantageous position in big ships by risking them in waters infested with submarines"⁷ ignored the fact that those submarines had made his capital ship ratios almost meaningless.

During the years between the world wars, the lessons of the submarine threat to both naval and merchant vessels were largely forgotten, and planners again resorted to force-on-force models and capital ship ratios as they struggled to limit the naval arms races that had preceded the "Great War". The Washington Treaty and London Naval Conference dealt with submarines only as an afterthought, allowing for submarine parity between navies and imposing a few largely meaningless limits on tonnage and gun caliber.⁸ American force planners fought an internal battle over whether submarines should be the small coastal defense platforms strongly favored by the Congress, or the larger and faster vessels able to

⁵ Van der Vat, Dan, *Stealth at Sea*, Houghton-Mifflin, Boston, 1995, 30.

⁶ *Ibid*, 33-36.

⁷ Harris, Brayton, *Submarines: A Political, Social and Military History*, Berkley, New York, 1997, 169.

⁸ Van der Vat, 133-136.

keep up with and support the "Battle Fleet" and favored by the battleship admirals.⁹ Fortunately for the outcome of the war in the Pacific the latter school won out and the resulting "fleet boats," although they never operated in the support role envisioned by their designers, had the range and speed to independently take the fight across the Pacific Ocean. A combination of complacency and benign neglect resulted in the "stable equilibrium" of submarine technology between the wars in which few changes occurred to either submarine technology or the ways in which navies thought to use them.¹⁰ As a result, the submarine campaigns of World War II were essentially an extension of those in World War I.

Following World War II, perceived advances in ASW technology and procedures again led force planners to believe that the days of the diesel submarine were numbered (perhaps a bit prematurely based on the still potent threat diesel submarines pose today) and drove the quest for nuclear propulsion to allow the submarine to remain submerged and stealthy indefinitely. Once achieved, the promise of nuclear power set designers' imaginations free and during the 1950's virtually every imaginable naval platform from tanker to aircraft carrier was proposed for conversion to a submarine.¹¹ While many of these ideas seem fanciful in retrospect, they were driven by the very real threat of tactical nuclear warfare at sea, which made even the hardest of battleships seem flimsy. This concern is being eerily echoed today as ever more lethal conventional weapons again put our surface forces at risk, particularly when operating in the littoral.

In the 1960's the threat of the rapidly expanding Soviet nuclear submarine fleet, accompanied by key sonar and torpedo developments, finally gave the U.S. submarine force

⁹ Harris, 260.

¹⁰ Lautenschlager, Karl, "The Submarine in Naval Warfare: 1901-2001", *International Security*, Vol II, No. 3, Winter 1986-87, 122.

¹¹ Ibid, 362.

a mission and a peer competitor with which to gage itself. The fast attack submarine, whose character is embodied most clearly in the Los Angeles class, was once again harnessed into the fleet support role, only this time as an ASW asset to counter the vast Soviet submarine armada, a role that the submarine force was to pursue almost single-mindedly for the next thirty years. The ASW battles of the Cold War, besides representing one of the most vigorous contests for technological superiority in human history, represented a fundamental change in submarine warfare. For the first time, submarines were engaged in symmetric force-on-force confrontations, with relative acoustic advantage and exchange ratios carefully determined and the U.S. SSN force sized almost entirely on the basis of countering the perceived Soviet threat. So overarching did this mission become that when the Soviet threat abruptly dissipated (in intent if not in capabilities) during the early 1990's, the U.S. submarine force was likewise set adrift, scrambling to justify its existence in the post-Cold War world. Nowhere was this shock more evident than in the cancellation of the SSN-21 construction program, following the realization that the mission for which the Seawolf submarine had been almost exclusively designed – the defeat of the Soviet submarine force – was accomplished before the first hull was launched.

Approaches to Submarine Force Planning

Force planning at its most basic necessarily begins with consideration of national interests and objectives in formulating a national military strategy consistent with the external security environment and internal resource constraints.¹² For the purposes of this study the current National Military Strategy and the CJCS Joint Vision 2010 will be assumed as the overall template for the forces of the early next century. Within this framework,

however, there are a number of alternative approaches that can be taken to specific force planning (summarized in Table I), each of which will be considered in turn as it applies to the submarine force.

Table 1: Summary of Force Planning Approaches¹³

Approaches	Drivers	Strengths	Pitfalls
Top-Down	Interests/Objectives/Strategy	-Ends focused -Systematic/macro view -Integrative	-Ignores constraints -Fear of challenging higher authority -Public awareness of strategy
Bottom-Up	Current military capability	-Emphasizes real world -Improves current plans	-Neglects future -Loses big picture
Scenario	Future situation or circumstances	-Specific focus -Encourages priorities -Dynamic	-World is unpredictable -Tends to be retrospective -Takes on life of its own
Threat	Opponents	-Focuses on future -Balance of power -Emphasizes capabilities	-Too simplistic -Retrospective -Hard to gage intent -Biased by quantitative data
Capability/ Mission	Function	-Realistic appraisal of capabilities -Sets priorities -Confronts uncertainty	-Tends to suboptimize -May ignore higher goals -Understates friendly strengths
Technology	Superior systems	-Stresses knowledge and creativity -Reduces casualties	-High cost for small gain -Higher risk -Works best against symmetric balanced forces
Fiscal	Budget/resource constraints	-Supports democratic process -Requires setting priorities	-May not reflect security environment -Tendency to "fair-share" -Worsens cyclical spending
Hedging	Minimizing Risk	-Assures balance and flexibility	-Exaggerates rival capabilities -Worst case scenarios have high cost

¹² Lloyd, Richmond M., "Strategy and Force Planning Framework" in *Strategy and Force Planning*, 1-15.

¹³ Bartlett, Henry C., G. Paul Holman, Jr. and Timothy E. Somes, "The Art of Strategy and Force Planning," in *Strategy and Force Planning*, 2nd ed, edited by the Strategy and Force Planning Faculty of the Naval War College, Naval War College Press, Newport RI, 1997.

Top-Down: Can Submarines Shape, Respond and Prepare?

The current National Military Strategy of Shape, Respond and Prepare Now is embodied in the strategic concepts of *strategic agility*, *overseas presence*, *power projection* and *decisive force*.¹⁴ The submarine's ability to contribute effectively to execution of these concepts will in large measure determine its success in force planning debates.

Forward presence is a key and enduring naval peacetime mission and plays strongly in the shaping goal of the national strategy, particularly as political and budgetary pressures inexorably reduce the stationing of other U.S. forces abroad. Surprisingly, submarines are rarely viewed as having a significant presence role, at least in the traditional conception of this mission. Because of their stealth (they're hard to see even on the surface) and fairly limited range of force options (there are no warning shots with torpedoes), they are often thought incapable of communicating the kind of overt warning conveyed by say, a carrier battle group.¹⁵ In addition, their nuclear propulsion plant has made their presence problematic in many of the foreign ports and naval exercises where they might make a constructive contribution to engagement, leading to the assertion that presence, as a mission, will never be a force builder for submarines.¹⁶ Nonetheless, the regional CINC's have repeatedly asserted that a considerable increase in peacetime deployed SSN presence is necessary, perhaps due their increased appreciation of the submarine's clandestine presence role, its unique ability to observe foreign forces without distorting their behavior as an overt presence would. However, as one of the pitfalls of a top-down approach is its insensitivity to cost it is doubtful that the value added by a peacetime presence mission can justify a

¹⁴ Joint Chiefs of Staff, *National Military Strategy of the United States*, Washington, 1997.

¹⁵ Breemer, Jan S. "Where are the Submarines", *U.S. Naval Institute Proceedings*, January 1993, 38.

significant plus-up in submarines from QDR levels without a corresponding warfighting requirement.¹⁷

In the crisis response role, submarines have again suffered in comparison with more conventional naval forces, "Where are the submarines?" *not* being the first question the President reputedly asks. The reason often cited is that the submarine lacks the range of responses necessary to deal with an escalating crisis, and thus is constrained to play only at the upper end of the conflict spectrum.¹⁸ The sinking of the Argentine cruiser Belgrano during the Falklands conflict is often cited as an example of this disproportionate response. Such criticisms are largely the result of the old torpedo-boat mentality and fail to account for the modern submarine's roles in special and strike warfare, which can give it as much or more versatility than a surface force in responding to certain situations. In addition, the submarine is the smallest independently deployable element of our naval forces, capable, at current force levels, of keeping 10-12 platforms continuously deployed and surging nearly fifty within thirty days in the event of a crisis. This agility and flexibility to be in many places at once may be increasingly important as our security concerns gravitate towards dealing with a number of smaller conflicts vice one or two large ones.

Preparing for the future is arguably the most difficult element of our national security strategy, given the uncertainty surrounding just what that future will hold. The submarines we plan today will not come on line for a decade and then are expected to operate for over forty years. To put it in terms of a century ago, we are trying to plan and build a submarine

¹⁶ Tritten, James J., *The Submarine's Role in Future Naval Warfare*, Naval Postgraduate School, Monterey, California, 1992, 13.

¹⁷ Such a complementary set of requirements did exist during the Cold War when peacetime surveillance missions against Soviet submarines directly correlated to the intended wartime ASW role of the U.S. SSN force.

¹⁸ Sir James Cable states, "the greatest weakness of the submarine is that has no equivalent to the graduated ladder of violence enjoyed by (gun-armed) surface warships" in *Gunboat Diplomacy: 1919-1979*, 2nd ed, The Macmillan Press, London, 1981, 152.

force capable of winning World War II using the knowledge and technology available to John Holland and his contemporaries. Joint Vision 2010, the JCS' template for future development, attempts only to look out some ten years in the future and while it identifies key operational concepts – such as *precision engagement* and *dominant maneuver* – it does little to project what sort of forces will be required to implement these. The Navy's operational concepts of ...*From the Sea* and *Forward...from the Sea* shifted the Navy's future focus to power projection ashore, but did not significantly alter the force structure we would use to accomplish that mission. Finally, while the newest concept of network-centric warfare appropriately shifts the focus from platforms to sensors and effects, it again begs the question of just what sort of forces will still be required. In short, while a top-down approach seems to be adequate for generating broad capabilities requirements of the future, it often falls short of being able to translate those into specific forces.

Bottom-up: Does It Start With Submarines?

The advantage of a bottom-up approach to force planning is that it starts with the forces you already have on hand which, in the case of submarines, have proved to be quite capable. Although largely built for the undersea supremacy competition of the Cold War, SSN's nonetheless have adapted admirably to a variety of missions since its end. When power projection ashore supplanted sea-control as the primary mission, the vertical launch systems (VLS) of the 688 class submarines were reloaded with the land attack TLAM (in place of the anti-ship TASM they were envisioned for), and the boats went on to employ them in several operations including the Gulf War. When diesel submarines in the littoral replaced nuclear submarines in the open ocean as the premier undersea threat, tactics and weapons were significantly modified but the same old SSN's were used to employ them.

When submarine support of special operations, largely neglected since the Korean conflict, again became an important mission, all SSN's began training for it, not just the one or two former SSBN's converted into dedicated swimmer delivery platforms.

The pitfall of the bottom-up approach is that it tends to propagate the existing way of doing business: it is evolutionary rather than revolutionary, incremental rather than sweeping. Thus the naval force structure resulting from a Bottom-up Review, despite significantly altered missions, looks much like a smaller version of the Cold War Navy. The submarine force, rather than risk a major setback by advocating a radically new submarine operational concept, tacitly acknowledged the Carrier Battle Group as the fundamental building block of U.S. naval power and climbed back into harness as a supporting element after a twenty year hiatus, despite the checkered history of submarines operating in that role.¹⁹ The resulting force structure implications were immediate and distressing: since no one could envision needing more than two SSN's per CVBG to perform the limited support missions required, a force level of 24 fleet SSN's, plus a few special purpose boats for the odd "special operation" seemed more than adequate.²⁰

Scenarios: Do Submarines Just Need a Better Script?

The scenario approach to force planning emphasizes a specific and tangible focus on a particular region and threat. A realistic story is created based on real-world information, which then enables planners to structure forces appropriately. Current scenarios focus on the Arabian Gulf and Korea as the most likely flashpoints for a Major Theater War (MTW), and both would seem to provide strong rationale for maintaining our submarine forces. The

¹⁹ Carey, Merrick and Loren Thompson, "Submarines and the Future of Seapower", *Strategic Review*, Fall 1996, 17.

Korean conflict would necessarily require an immense sealift effort into a few South Korean ports, against a North Korean navy with one of the largest submarine fleets in the world. The Southwest Asia scenario depends on unimpeded access through the Strait of Hormuz, denial of which is well within the capabilities of even Iran's small submarine force when taken together with Iranian cruise missile and mine warfare assets.

The weakness of scenario-based planning is a tendency towards retrospection, the assumption that tomorrow will be like today, which in turn is like yesterday. Since both the Korean and Southwest Asia scenarios have already been fought, and neither involved a significant contribution by submarine forces the last time around, why should things be any different this time? Force planning for both regional contingencies together calls for far fewer than 50 SSN's, but assumes that our seaborne forces will be able to operate with impunity and the steady flow and re-supply of our forces by unopposed sealift. Such assumptions ignore the fundamentally reactive nature of war, particularly the ability of our once and future opponents' to also learn lessons from the past.

Another common weakness of scenario planning is dependence on the "most-likely" outcome. Although planners can usually envision a "worst case" in which things don't go quite as well as we would like, they often their planning on the most-likely rather than the most-dangerous scenario. The National Defense Panel, for instance, developed four alternative world scenarios for the year 2020 – a benign world of global harmony, an extrapolated world of today, a world of multi-polar competition and a world of chaos.²¹ However, the force alternatives they went on to consider were primarily focused on the two

²⁰ Some think that submarines are superfluous to a CVBG in that they are likely to be more hindrance than help in the event of an undersea war, due to the difficulty in differentiating between "good" and "bad" submarines.

²¹ National Defense Panel, *Transforming Defense: National Security in the 21st Century*, Washington, 1997, 8-9.

middle cases, the "average" path. Paradoxically, it is precisely in the "worst cases" that the submarine's strengths of stealth, self-sufficiency, and endurance become most valuable.

Threat: Are the Dragons Really Out There?

The Soviet submarine threat of the Cold War was the primary driver for development of our current submarine force structure. Concrete and quantifiable, it was the force planner's ideal, a symmetric force-on-force comparison backed up by real-world data from our covert missions. Although the Soviets kept getting better, the mainly evolutionary improvements in their capabilities were relatively easy to extrapolate from past data, and in turn justified ever-improved U.S. submarine capabilities. The culmination of this process was the SSN-21 "Seawolf"-class submarine, a platform built with the single purpose of maintaining undersea superiority over the projected Soviet threat into the next century.

With the demise of the Soviets, threat-based planning was turned on its head. If the sole mission of the submarine force was ASW and the principal submarine threat had evaporated, why did we still need SSN's? Proponents quickly turned to the diesel submarine, which had been quietly proliferating in the rest-of-the-world (ROW) navies, as the new threat, especially in light of the Navy's operational shift to the littoral where such submarines were likely to be found. But now the threat-based planning problem was a bit more complicated. Although there are a lot of diesel submarines out there, only a few are owned by any given opponent and it is unlikely we would have to take them on all at once. Also, these submarines come in a wide variety of capabilities and crew-proficiency levels, making a one-size-fits-all approach impossible. Finally, there is the problem that in the littoral environment, finding and eliminating a well-operated diesel submarine is a very tough

problem for an SSN, at least in the short timeframe over which most operational planners expect to sweep them from the sea lanes.

The problem with the threat-based approach is that it is reactive and linear by nature, and tends to seek symmetric force-on-force comparisons (i.e. how many SSN's are required to counter three Kilo SS?). Thus the case of a diesel submarine in the littoral was treated in isolation as if it were similar to that of a Soviet nuclear sub in the open ocean. In fact, however, the littoral diesel threat is amplified by a number of factors not specifically related to the submarine itself, including the effects of sea mines and cruise missiles against surface ASW combatants and surface-to-air missiles and land-based air forces against air ASW platforms. The synergy of these asymmetric "access-denial" threats is likely to make operation of our conventional naval and sealift forces in the littoral increasingly untenable over the next several decades.²²

The right question to ask, then, is not simply "how can we kill diesel submarines?" but rather "how can we neutralize the access-denial threat in the littoral posed by a combination of diesel subs, land-based cruise missiles and sea mines?" The rest-of-the-world diesel submarine is neither equipped for nor proficient at anti-submarine warfare, nor is it likely to become so without an enormous effort and investment in ASW paralleling that of the U.S. Navy in the 1960's. Consequently, the key advantage of the SSN as a platform lies not its ability to prosecute diesel submarines (although it is still arguably the best platform for that, as well), but rather its ability to operate with near impunity in their vicinity. In other words, instead of trying to figure out how many SSN's we need to protect the CVBG in the littoral, perhaps we ought to be calculating how many we need to replace it.

²² Davis, Jacquelyn K., "The Submarine's Role in the 21st Century", *Sea Power*, July 1997, 35.

Capabilities and Missions: Is the SSN a Platform for All Seasons?

The mission approach to force planning is one uniquely attuned to the Navy's platform-based structure. It starts with the broad requirements levied by strategy – such as strategic deterrence, power projection and presence – and breaks them down into specific activities that can be assigned by platform. Although this approach can result in sub optimal platform specialization and prevent achieving synergistic effects – such as those envisioned by the Navy's Network-Centric warfare concept – it has the advantage of providing a balanced capability independent of any specific threat. The National Defense Panel largely followed this approach in making their recommendations for the 21st century. After reviewing the expected battlespace environment, the *critical force capabilities* they emphasized were: *stealth, mobility, reduced dependence on logistics, speed, increased strike range, and precision strike capability*. Remarkably, no other platform embodied so many of these aspects as did the SSN.²³

The trend over the past decade has been increasingly to shift from single-mission to multi-mission naval platforms, such as combining the AAW capabilities of a cruiser and ASW of a destroyer into a single DDG. The SSN has likewise been transformed from a predominantly ASW role into a multi-mission platform with enhanced capabilities in strike, reconnaissance, and special warfare in addition to its traditional sea control functions. The risk of this is in going from the premier single-mission platform to a mediocre performer of several – the proverbial jack-of-all-trades, master of none. There is also an inherent difficulty in assessing the effectiveness of a multi-mission platform, be it surface ship, aircraft or submarine, since executing one mission well invariably results in some trade-offs

²³ National Defense Panel, *Transforming Defense: National Security in the 21st Century*, Washington, 1997, 45.

for others. Submarines, for instance, achieve their stealth only at the loss of considerable connectivity with other forces, a key issue for a network-centric vision of the future.

While the submarine force has demonstrated capabilities in many missions, it has not demonstrated equivalent commitment to some of them. In the case of land-attack warfare, the principal mission of the "...From the Sea" operational concept, the submarine force has not purchased enough TLAM's to reload existing platforms, long resisted efforts to convert four Tridents to SSGN's, and almost left a vertical launch system out of the design for the new Virginia-class SSN.²⁴ Why has the submarine force, which led the way in the conceptualization of the SSBN strategic strike mission, been so slow to adopt a meaningful operational strike capability? Part of the problem stems from an apparent inability to do the weapons payload arithmetic required in shifting from a sea-control to a power projection role. While a single torpedo can prove decisive in a sea-control mission because of its unique and inherently leveraged destructive effect (it puts the entire ship and its contents on the bottom), a single TLAM (despite its approximately equivalent warhead size) has a relatively more modest effect on a par with a number of other strike munitions, most of which are available in far greater numbers to the strike planner. Thus a one-for-one trade of torpedoes for missiles leaves the SSN competitively disadvantaged relative to many other strike platforms. Failure to increase weapons payloads by an order of magnitude will inevitably limit submarine contribution to the strike mission to no more than a token level, as in the Gulf War where submarine-launched Tomahawks accounted for less than 0.1 percent of all strikes. It is hard to imagine that such an insignificant mission contribution could be effectively used as a serious argument for increased submarine force structure.

²⁴ Snider, Don M. ed, *Attack Submarines in the Post-Cold War Era*, Center for Strategic and International Studies, Washington, 1993

Technology: Are Submarines 21st Century Marvels or Holdovers from the 19th?

In many ways the submarine is the ultimate achievement of industrial age warfare. It is a highly evolved and self-contained system, capable of proceeding independently on its mission for months at a time, bearing with it virtually all the capabilities required to find and attack its target. However, that capability has come at the cost of enormous complexity and a certain degree of technological rigidity. In the SSN-21, for instance, the technology was clearly evolving past the limiting point of return, requiring enormous additional investments for incremental increases in capability. With the decision to cancel that platform and start from scratch on the New Attack SSN, more recently named the "Virginia" class, it appeared that the submarine force could take advantage of the low-risk "threat window" over the next decade to come up with a true "SSN for the twenty-first century", a revolutionary platform with unmatched capabilities to deal with the contingencies of the future.

Unfortunately, the "Virginia" class, despite a number of individually interesting improvements, looks to be far more of an evolutionary than revolutionary platform. While the Defense Science Board found the NSSN to have a "first-rate propulsion system", it was considerably more restrained in its enthusiasm for the front end of the submarine.²⁵ In fact, the NSSN does little to break the "tyranny of the 21-inch torpedo tube" which has so effectively prevented submarines from evolving beyond their torpedo-boat role. The Virginia's payload capability remains unchanged from that of a 688 and the payload interface will not readily adapt to non-torpedolike weapons. Its much vaunted modularity will mean the design can be more easily adapted during mid-build or overhaul, but not that it can be reconfigured in response to operational requirements. Sensor systems, although improved by

²⁵ Defense Science Board Task Force, *Report on the Submarine of the Future*, Office of the Undersecretary of Defense for Acquisition and Technology, Washington, 1998, 22-24.

Commercial Off-the-Shelf Technology for data processing, still emphasize a centralized on-board architecture rather than the distributed off-board sensor net of the future. Even the propulsion system focuses more on "Seawolf level of quieting" (Cold-War thinking) than advances such as electric drive that could increase flexibility for advanced weapons and payload interfaces. In short, the Virginia-class SSN appears to continue down the same path of limiting returns from technology that doomed its predecessor and is unlikely to spark a technology-based increase in demand for submarine platforms.

Fiscal: Can Anyone Afford a \$2B Submarine?

The fiscal approach to force planning is driven by the bottom line. In an era of fixed or declining defense budgets and little evidence of a threat which will change the inclination of Congress or the American public to pony up any more money, force planners must be able to provide a compelling case for new weapons systems in terms of "bang for the buck". The submarine force that performed so well in World War II represented a tiny four percent of the Navy procurement budgets of that era. The two billion dollar NSSL, even building just one per year, will absorb nearly 25 percent of ship procurement budget for the next decade.

Nuclear submarines costs are driven, to a much greater extent than any other platform, by the very propulsion system which gives it so many of its advantages. While the hull, mechanical and electrical costs of a surface ship are generally less than 25 percent of the total, they exceed 50 percent of the cost of a nuclear submarine. Suggestions for a return to conventionally-powered submarines are common, but beg the question of the need for a nuclear submarine's endurance and stealth in carrying out the forward-deployed missions of our Navy. The most compelling empirical evidence against diesels comes from the Royal Navy in the early 90's which, when faced with a choice between decommissioning two of

their nuclear submarines or four highly capable diesel boats, chose to keep the nuclear subs, even though British submarine missions are typically much closer to the homeland than ours.

Given that nuclear propulsion is here to stay, how can it remain a viable proposition? If submarine and surface ship missions continue to converge, as they have in the role of land-attack, how will the bean counters justify a ship that carries less than half the payload at twice or more the cost? One option might be through the conversion of excess (under START II) Trident SSBN hulls to a submerged version of the "arsenal ship", upping the strike payload by a factor of six over an SSN at little increase in manning and procurement costs. Consideration has also been given to double-crewing SSN's, which have far lower operating costs relative to procurement cost than surface ships, and thereby increase the effective on-station time and return on investment for these capital intensive platforms.

Hedging: A Safe Bet or Paralysis by Indecision?

Hedging is the approach of preparing for every possible contingency through redundant systems, multiple employment options and a spreading of risk, whether technological or military. Besides being almost impossibly expensive, hedging represents a way of avoiding, rather than making, a decision about the future of our forces.

Unfortunately, it also most resembles the process of force planning that has been predominant since the end of the cold war. For the submarine force, this has meant a schizophrenic shifting between dealing with a renascent Russian submarine threat, becoming a fully-integrated support element of the battle group, achieving a stand-alone land attack capability, dealing with ROW diesel submarines and supporting special forces. By attempting to do everything, and refusing to make the hard decisions about what is beyond our capabilities (or at least fiscal limitations) we risk ending up with nothing. If hedging is to

work for the submarine force, it must be in the sense of investing sufficient resources in a variety of approaches to reserve the "right to play" while building a platform that can be readily adapted to whichever approach proves most appropriate to the next century.

Conclusions

In an ideal world, all approaches to force planning would converge towards a single "right" answer, but as the foregoing discussions indicate, this is unlikely to be the case for the submarine force. Uncertainty about the future, honest differences of opinion and differing approaches to the problem will continue to yield a range of solutions. Top-down planning, for instance, seems to argue for more submarines, while a bottom-up approach indicates we can get along with fewer. Scenarios based on replays of past conflicts may show little role for SSN's, but also may ignore our opponents' ability to react to the lessons of those wars. The proliferation of threats in the littoral environment may circumscribe the operation of surface forces there in the future, but submarines have yet to seriously demonstrate the flexibility to take over the full spectrum of naval missions. Submarine technology is arguably the best in the world but seems limited by decreasing returns on investment and an inability to break out of the norms of the past. Finally, the traditional approach of hedging is on a collision course with budget realities as the spiraling cost of naval platforms makes their justification in terms of specific threats or missions ever more necessary.

From this seeming mass of contradictions, there nonetheless emerge some clear truths for submarine force planners of the future. First, the submarine has returned to its original role as an *asymmetric* weapon. With no adversary likely to field a comparable force in the foreseeable future, planners can no longer resort to symmetric force-on-force comparisons as a basis for submarine levels, and the submarine's value must be defined in terms of the

effects it can produce across the entire spectrum of war. Second, the multi-polar world of the next century will be likely characterized by far more uncertainty and non-linearity than the bipolar Cold War era. The linear extrapolation methods that enabled us to predict what level of quieting or sensor performance we would need 10 or 20 years in the future are thus unlikely to provide useful results in a world in which a number of small "entrepreneurial" submarine navies are exploring a variety of new technologies and tactics. We must build platforms able to *adapt*. Third, the submarine force's avowed espousal of multiple missions must be backed up by an equivalent commitment of resources. Effective solutions to the problems of increasing weapons payload and flexibility, incorporating distributed sensor architectures, linking submarines into the information backplane and increasing the operational return on submarine construction capital must take precedence over simply building more Virginia-class SSN's. Finally, the submarine force, along with the rest of the Navy, must move beyond timeworn and intrinsically limited missions such as the battle-group support, and forge a new operational concept that links the submarine's unique capabilities more directly to joint missions in surveillance, special operations and power projection that will be the key to our national security in the next century.

As with any highly successful organization, the submarine force has developed a "thick" culture, one capable of responding energetically to external challenges whether they are new enemy submarine technology or threatened budget cuts. It is far more difficult for such organizations to turn their vision upon themselves, recognize their shortcomings and initiate change from within. Failure to do so, however, will condemn the submarine to the same gradual lapse into irrelevance during the twenty-first century as it did the battleship in the last.

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